

PALAEOANTHELLA HUANGII GEN. AND SP. NOV.,  
AN EARLY CRETACEOUS FLOWER (ANGIOSPERMAE)  
IN BURMESE AMBER

George Poinar Jr.

Department of Zoology  
Oregon State University  
Corvallis, Oregon 97331, U.S.A.

Kenton L. Chambers

Department of Botany and Plant Pathology  
Oregon State University  
Corvallis, Oregon 97331, U.S.A.

ABSTRACT

**Palaeoanthella huangii** gen. & sp. nov. is described from an Early Cretaceous staminate flower in Burmese amber. The genus is characterized by small, staminate flowers composed of a cup-shaped perianth of 8 fused lobes (tepals) arranged in one series with 8 equal subsessile, unappendaged stamens in a single whorl, more or less alternating with the tepals, and having 2 lobed, 4-locular anthers opening by longitudinal slits. Adjacent pollen considered to have originated from the anthers is inaperturate with finely ridged and grooved exines. The fossil shows possible affinities with the eumagnoliid angiosperm family Monimiaceae.

KEY WORDS: Burma, fossil, fossilized resin, Monimiaceae, Myanmar

RÉSUMÉ

**Palaeoanthella huangii** gen. et sp. nov. est décrit à partir d'une fleur du Crétacé inférieur de l'ambre de Birmanie. Le genre est caractérisé par ses fleurs petites, staminées, composées d'un périanthe en forme de cupule, formé de huit tépales fusionnés en une série simple et alternant plus ou moins avec huit étamines sans appendice. Les anthères possèdent deux lobes et quatre locules s'ouvrant par des fentes longitudinales marginales. Le pollen trouvé à côté des anthères est considéré comme provenant de ceux-ci ; il est inaperturate, avec des exines finement carénées et rainurées. Ce fossile montre des affinités possibles avec les Angiospermes Eumagnolides de la famille Monimiaceae.

INTRODUCTION

A new genus and species of angiosperm with possible affinities with the family Monimiaceae is described from Early Cretaceous Burmese amber. Since the Early Cretaceous was a period of early angiosperm diversification, all specimens from this time period are extremely important in establishing a minimum age for the appearance of various floral characters. While only a single staminate specimen is available for study, it is well preserved and presents an interesting arrangement of staminal features.

MATERIALS AND METHODS

The piece of amber containing the flower weighs 2.8 gm and is more or less trapezoidal in outline, with a greatest length of 25 mm, greatest width of 19 mm and greatest depth of 7 mm. The flower is situated about 5 mm under the surface of the amber. Due to the presence of insect fossils adjacent to the flower,

the amber could not be re-polished further. Examination and photographs were made with a Nikon stereoscopic microscope SMZ-10 R at 80 $\times$  and a Leica Wild M3Z stereoscopic microscope at 400 $\times$ . Pollen grains in the amber adjacent to the flower were photographed with a Nikon Optiphot microscope at 600 $\times$ .

Amber from Burma occurs in lignitic seams in sandstone-limestone deposits in the Hukawng Valley, southwest of Maingkhwan in the state of Kachin (26°20'N, 96°36'E). Nuclear magnetic resonance (NMR) spectra of amber samples taken from the same locality as the fossils indicated an araucarian (possibly *Agathis*) source of the amber (Lambert & Wu, unpublished data, 2002). Palynomorphs from the amber beds where the fossil originated have been assigned to the Upper Albian of the Early Cretaceous (97–110 million years ago) (Cruickshank & Ko 2003); however, since the amber is secondarily deposited, the age could be older.

#### DESCRIPTION

The flower is approximately 1 mm in diameter. The conspicuous anthers are situated in a whorl at the edge of the receptacle. Since the flower is funnel-shaped, it was difficult to obtain a photo from the top with all its features in focus. Pollen grains attached to the anthers and tepals and in the amber adjacent to the flower indicate that the flower was in anthesis when it entered the resin. The pollen grains illustrated here are considered to have originated from the flower since 1) they are the same size as those on the anthers, 2) they are adjacent to the flower, and 3) a search through the rest of the amber matrix did not reveal any grains similar to those adjacent to the flower.

**Palacoanthella** Poinar & Chambers, gen. nov. TYPE SPECIES, *Palacoanthella huangii* Poinar & Chambers, sp. nov.

Unisexual; staminate flowers small, actinomorphic, perianth cup-shaped, united, bearing 8 lobes (tepals) arranged in one series; tepals connate below, separate above, low, rounded at tip; receptacle bearing 8 equal, subsessile stamens in a single whorl; stamens unappendaged, alternating with tepals; anthers 4-locular, opening lengthwise by marginal slits; pistillate flowers unknown.

**Palacoanthella huangii** Poinar & Chambers, sp. nov. (Figs. 1–2). TYPE: MYANMAR (BURMA): KACHIN: northern Myanmar, Amber mine in the Hukawng Valley, SW of Maingkhwan, (26°20'N, 96°36'E), Jul 2004, *Chialang Grand Huang, Burmese-97* (HOLOTYPE: male flower deposited in the collection of Chialang Grand Huang, Edison, New Jersey 08820, U.S.A.).

**Single staminate flower:** dimensions of 945  $\mu$ m across shorter axis and 1094  $\mu$ m across longer axis (the difference between the axes is because the tepals on one axis have been eaten by an herbivorous insect); perianth cup-shaped, 34  $\mu$ m long, externally hispidulous; stamen length, 270–338  $\mu$ m; stamens subsessile, the four visible filaments ranging from 27–40  $\mu$ m in length; anthers 270–338  $\mu$ m in length, basifixed, opening by lateral slits; center of receptacle

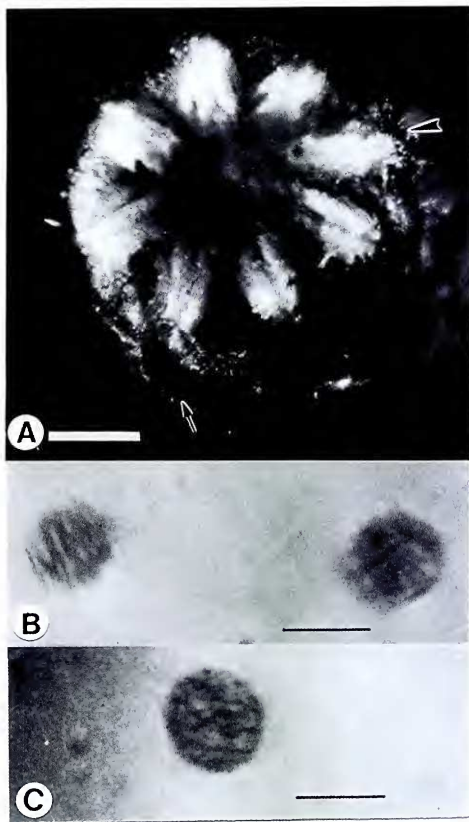


FIG. 1. A. *Palaeoanthella huangii* in Burmese amber. Scale bar = 217  $\mu\text{m}$ . Arrow shows a complete tepal; arrowhead shows tepal damaged by a micro-herbivore. B. Two pollen grains adjacent to *P. huangii*. Scale bar = 15  $\mu\text{m}$ . C. Single pollen grain adjacent to *P. huangii*. Scale bar = 15  $\mu\text{m}$ .

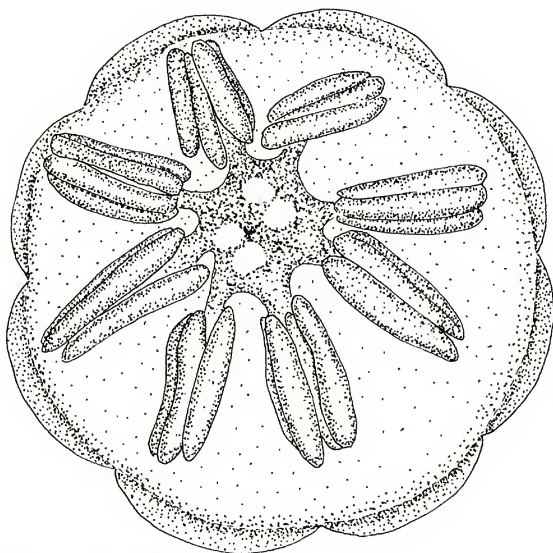


FIG. 2. Partly reconstructed flower of *Palaeoanthella huangii* in Burmese amber. Scale bar = 500  $\mu\text{m}$ .

filled with spongy tissue; pollen grains inaperturate, nearly spherical, 17–20  $\mu\text{m}$  in diameter, exine finely ridged and grooved.

*Etymology*.—Genus name from the Greek “palaios” for ancient, old, the Greek “anthos” for flower and -ella as a diminutive ending for small. Species named after Chialang Grand Huang, who loaned this valuable specimen for study.

#### DISCUSSION

It is impossible to assign this flower to a present day family with certainty. However, it does possess some characters [small, unisexual, actinomorphic flowers, cup-shaped monochlamydeous perianth, subsessile stamens, reduction in size of tepals; four-locular anthers opening by 2 lateral longitudinal slits (in staminate flowers with a relatively open floral cup)] found in the family Monimiaceae (Melchior 1964; Hutchison 1966; Endress 1980; Philipson 1986, 1993). Several

extant genera of the Monimiaceae have similar features. *Mollinedia* has unisexual flowers with a cup-shaped floral base. While there are numerous stamens in this genus, the filaments are very short and the anthers open lengthwise by slits (Perkins 1901). Another genus is *Kibara* with small unisexual flowers in a hemispherical cup with 8 lobes arranged in 4 series, and 4 stamens. However the anthers open by a single apical slit (Perkins 1901). No extant members of this family have 8 stamens arranged in a single whorl, with the number of stamens equal to the number of tepals and more or less alternating with the tepals.

Pollen of the Monimiaceae varies considerably in size and shape, ranging from spherical to ellipsoidal and from 10 to 50 microns in diameter (Money et al. 1950). Erdtman (1966) describes the grains as usually nonaperturate, 2(-3)-sulcate or oligofor(aminoid)ate, tenui-exinous. The exine can be thick or thin and can appear as granular, finely pitted-reticulate, spinuliferous, ridged or grooved (Money et al. 1950; Sampson 1993). Acolpate pollen with ridged and grooved exines similar to those adjacent to the fossil occurs in the extant genus *Tambourissa* (Money et al. 1950).

It is difficult to identify any defined structures in the center of the flower that might represent stamen appendages, nectaries, or vestigial carpels.

The occurrence of the Monimiaceae in the Lower Cretaceous would be consistent with the primitive status of this family as determined by morphological and molecular findings. Based on their analysis of the plastid *matK* gene sequences of various angiosperms, Hilu et al. (2003) placed the Monimiaceae, together with the rest of the Laurales, in the informal group eumagnoliids, which together with the Chloranthales and monocots, form a sister group to the eudicots. The separation of Monimiaceae *sensu stricto* from the related families Siparunaceae, Gomortegaceae, and Atherospermataceae is supported by the molecular studies of Renner (1999) based on data from six plastid genome regions. The Monimiaceae occur in warm temperate to tropical areas of the southern hemisphere and enter the Eurasian mainland in Malaysia and Thailand. There are no records of this family in Burma today.

The chewed tepals on *P. huangli* are evidence of herbaceous insect activity, possibly by a beetle or moth larva. The tip of one of the anthers also shows bite marks, indicating indiscriminate feeding on flower parts. The disturbance caused by the herbivore could have dislodged the flower and caused it to fall in the resin.

Several insects groups appear to be involved in the pollination of members of the Monimiaceae. A species of thrips (*Thrips setipennis*) was reported as the sole pollinator of *Wilkiea huegeliana* in an Australian subtropical rainforest, with both male and female flowers serving as brood sites for thrip larvae (Williams et al. 2001). In Ecuador, members of the genus *Siparuna* are pollinated by gall midges of the family Cecidomyiidae. These insects deposit their eggs in the male flowers where the larvae presumably feed on the tissues (Feil 1992). Both gall

midges and thrips occur in Burmese amber and representatives of these groups could have pollinated *P. huangii*. A gall midge is preserved near the fossil flower.

Since the amber mines are located on the Burma Plate, which is part of Laurasia (Mitchell 1993), *P. huangii* can be considered of Old World origin.

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